

11: The Jovian Planets

Learning Objectives

- Describe the properties and composition of the four Jovian planets.
- Compare the atmospheres of Jupiter, Saturn, Uranus, and Neptune.
- Compare the magnetospheres of Jupiter, Saturn, Uranus, and Neptune.
- Compare the internal properties of the four Jovian planets.

Beyond the asteroid belt, orbit the Jovian planets. the Jovian planets are very different than the inner terrestrial planets. While the terrestrial planets are small, rocky bodies, the Jovian planets are gaseous without a solid surface. The two largest, Jupiter and Saturn, are mostly hydrogen and helium and are referred to as the **gas giants**. Uranus and Neptune also contain some hydrogen and helium, but also contain a lot of hydrogen compounds like water (H_2O), methane (CH_4), ammonia (NH_3). Astronomers refer to these compounds collectively as “ices” and refer to Uranus and Neptune as **ice giants**.

All the Jovian planets are much larger and much less dense than the terrestrial planets. In fact, Saturn is less dense than water, which means, if you could find a bathtub big enough to fit it, it would float. Uranus and Neptune are denser than Saturn because they have less H/He, proportionately, and more ices. Though similar in composition to Saturn, Jupiter is denser because of compression. Its large mass causes more pressure on the hydrogen and helium, squeezing them into a denser configuration. In fact, Jupiter may be at the upper limit for how large a Jovian planet can get. Adding more mass to it would cause more compression, further squeezing the planet into a smaller radius.

Being large balls of gas gives the Jovian planets mean they do not rotate uniformly. They spin faster at the equator than at the poles. They are also not quite spherical because of their rapid rotation, being flattened at the poles. In addition, all the Jovian planets have strong winds and storms caused by convection and rotation. All the Jovian planets have substantial magnetospheres, but Jupiter's is the largest by far.

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